MYCOTAXON

ISSN (print) 0093-4666 (online) 2154-8889 Mycotaxon, Ltd. ©2018

July–September 2018—Volume 133, pp. 415–421

https://doi.org/10.5248/133.415

First records of *Hydnobolites* and *Pachyphlodes* species from Turkey

Yasin Uzun & Abdullah Kaya*

Department of Biology, Science Faculty, Karamanoğlu Mehmetbey University,
Yunus Emre Campus, Karaman, Turkey

* Correspondence to: *kayaabd@hotmail.com*

Abstract—The genera *Hydnobolites* and *Pachyphlodes* (*Pezizaceae*) are recorded from Turkey for the first time, based on collections of *Hydnobolites cerebriformis, Pachyphlodes citrina,* and *P. conglomerata.* Brief descriptions and photographs of the species are provided.

Key words—biodiversity, hypogeous ascomycete, truffle-like fungi

Introduction

Hydnobolites Tul. & C. Tul. and *Pachyphlodes* Zobel are two hypogeous ascomycete genera currently positioned in the family *Pezizaceae* Dumort. Kirk & al. (2008) and Healy & al. (2009a) report the existence of three described species of *Hydnobolites* and 12 described species of *Pachyphlodes.*

Species of *Hydnobolites* and *Pachyphlodes* are generally characterized by hypogeous and subglobose ascomata; ellipsoid to pyriform or broadly ellipsoid to clavate or cylindric, 8-spored asci; and globose, ornamented ascospores (Gilkey 1939, 1954; Hawker 1954; Pegler & al. 1993; Læssøe & Hansen 2007; Healy & al. 2009b; Trappe & al. 2009).

Thirty-nine members of *Pezizaceae* within *Adelphella* Pfister & al., *Iodophanus* Korf, *Marcelleina* Brumm. & al., *Pachyella* Boud., *Peziza* Dill. ex Fr., *Plicaria* Fuckel, *Sarcosphaera* Auersw., *Terfezia* (Tul. & C. Tul.)

Tul. & C. Tul. and *Tirmania* Chatin have so far been identified from Turkey. According to checklists (Sesli & Denchev 2014, Solak & al. 2015) and recently published data (Türkoğlu & al. 2015, Kaya & Uzun 2015, Elliot & al. 2016, Akata & Sesli 2017, Işık & Türkekul 2017, Sesli & Vizzini 2017, Türkekul 2017, Uzun & al. 2017a, b), no species of *Hydnobolites* and *Pachyphlodes* have previously been recorded from Turkey.

Here we report *Hydnobolites* and *Pachyphlodes* as the tenth and eleventh genera of Turkish *Pezizaceae* with the collections of *Hydnobolites cerebriformis, Pachyphlodes citrina,* and *P. conglomerata.* The study aims to contribute to the mycobiota of Turkey.

Materials & methods

Specimens were collected from Giresun, Rize, and Trabzon provinces in 2016 and 2017. Necessary ecological data were recorded, and the fruit bodies were photographed in the field. Macroscopic and microscopic measurements were performed in the laboratory. The material was mounted in Congo Red or Meltzer's reagent and observed microscopically using a Nikon Eclipse Ci-S trinocular light microscope. The specimens were identified with the help of Soehner (1935), Gilkey (1939), Vacek (1949), Hawker (1954), Lange (1956), Cazares & al. (1992), Pegler & al. (1993), Vidal (1997), and Hensel & Huth (2004). The specimens are preserved in the fungarium of Department of Biology, Science Faculty, Karamanoğlu Mehmetbey University, Karaman, Turkey (KMU).

Taxonomy

Hydnobolites cerebriformis Tul. & C. Tul.
Ann. Sci. Nat., Bot., Sér. 2, 19: 279 (1843) FIG. 1

ASCOMA 6–30 mm in diameter, hypogeous, more or less globose, irregularly lobed or cerebriform, some with a small base formed by mycelial remnants mixed with substrate soil; surface glabrous, ochraceous yellowish to light brown. PERIDIUM with a pseudoparenchymatic structure of globose to isodiametric cells. GLEBA compact, concolorous with the surface or lighter. ODOR soft and pleasant. ASCI 80–130 × 65–90 µm, globose, thin-walled, generally 8-spored (some with 5–6 spores). ASCOSPORES 15–25 µm in diameter, spherical, thick–walled, hyaline and somewhat smooth at first, yellowish and reticulo–alveolate at maturity.

SPECIMENS EXAMINED—**TURKEY, RIZE, Ardeşen,** Eskiarmutluk village, 41°07′N 41°08′E, 610 m, mixed forest, in soil under *Corylus*, 5.08.2016, Y. Uzun 5182(KMU); **TRABZON, Tonya,** Sayraç village, 40°54′N–39°13′E, 1100 m, mixed forest, under *Fagus orientalis,* 8.11.2016, Y. Uzun 5415 (KMU).

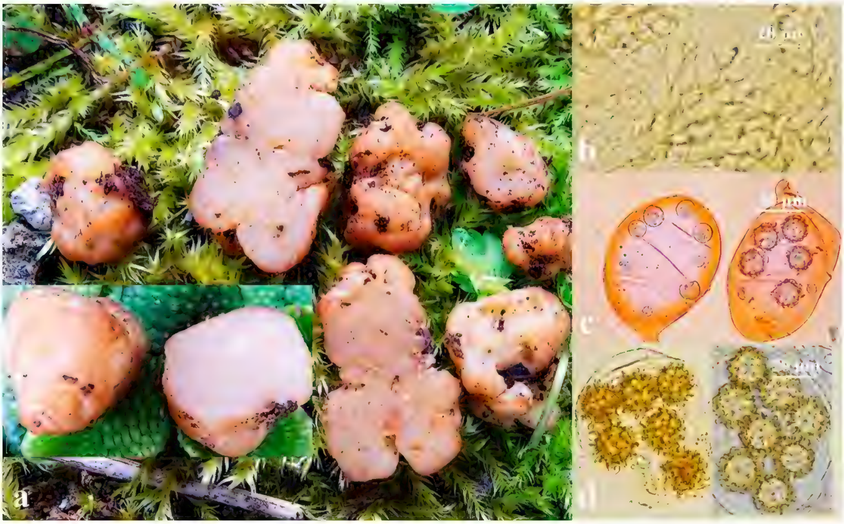

Fig 1. *Hydnobolites cerebriformis* (KMU, Y. Uzun 5415).
a. Ascomata; b. Peridium; c,d. Asci and ascospores.

Comments—Although Pegler & al. (1993) and Vidal (1997) reported the maximum size of ascomata as 13 and 10 mm, respectively, some of our samples reached almost to 30 mm. All the other morphological characteristics of the samples agree with the literature.

Pachyphlodes citrina (Berk. & Broome) Doweld,
Index Fungorum 31: 1 (2013) Fig. 2

Ascoma 10–30 mm in diameter, spherical, subglobose or irregularly lobed with an apical opening and a basal brown mycelial tuft, initially yellow to bright orange, later brown, dark brown to blackish, surface covered by 4–5 sided pyramidal warts. Peridium pseudoparenchymatous. Gleba compact, whitish with yellow veins when young, turning to bluish gray initially and in maturity or in contact with air to dark greenish gray; veins seem to be radiate from the base of the ascoma to the ostiole, some arising at the peridium and terminating after a short distance. Odor soft and pleasant when young, becoming strong and unpleasant during the early decay stage. Asci 120–160 × 38–45 µm, clavate to very broad, tapered below, stipulate, mostly 8-spored, spores biseriate or arranged irregularly. Ascospores 13–15 µm in diameter,

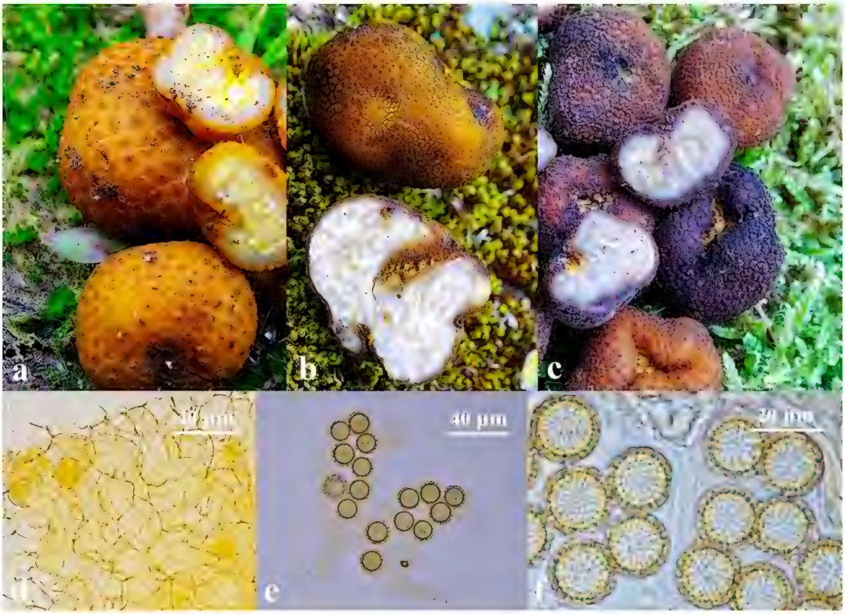

Fig 2. *Pachyphlodes citrina* (KMU, Y. Uzun 5152).
a–c. Ascomata; d. Peridium; e,f. Asci and ascospores.

spherical, covered with small 1.3–2 µm high sticks or truncated conical spines; first hyaline, then yellowish.

Specimens examined—TURKEY, **Trabzon, Tonya,** Hoşarlı village, 40°56′N–39°18′E, in soil under *Quercus*, 740 m, 22.05.2016, Y. Uzun 5124; 20.06.2016, Y. Uzun 5152 (KMU); **Rize, Ardeşen,** 41°10′N 41°06′E, 340 m, Ortaalan village, in soil under *Corylus*, 9.07.2017, Y. Uzun 5635 (KMU).

Comments—The ascomata and habitat of our Turkish specimens generally conform to descriptions of *P. citrina* by previous mycologists (Soehner 1935, Gilkey 1939, Pegler & al. 1993, Vidal 1997). Our samples well fit with those reported by Gilkey (1939). Although truffles generally emerge upwards at maturity (Healy 2003), we collected most of our young fruit bodies close to the soil surface while obtaining our mature samples were at soil depths of 15–20 cm. When soaked in water, our dry samples smell like a boiled potato.

Pachyphlodes conglomerata (Berk. & Broome) Doweld
Index Fungorum 31: 1 (2013) Fig. 3

Ascoma 7–20 mm across, subglobose to irregular or lobed with an apical depression and a short hairy basal stalk, surface smooth or slightly tomentose

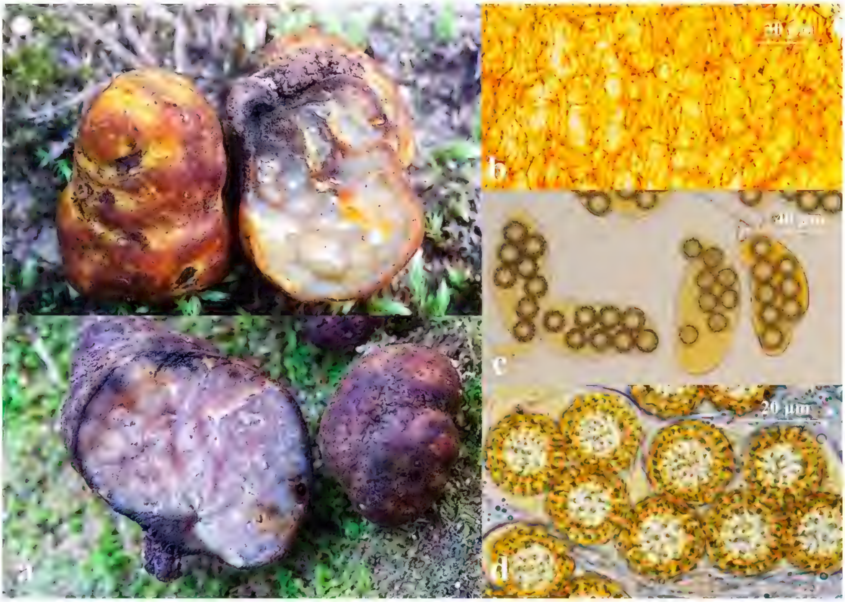

Fig 3. *Pachyphlodes conglomerata* (KMU, Y. Uzun 5839).
a. Ascomata; b. Peridium; c,d. Asci and ascospores.

and yellow when young, then rough or wrinkled-lobed and brownish-yellow to (finally) blackish-brown. Peridium pseudoparenchymatous, walls of outer cells coloured. Gleba olive-yellow to gray when young, becoming dark gray to dark gray-brown at maturity; sparsely and indistinctly veined, veins whitish, but turning yellow in contact with air. Odor not distinctive. Asci 140–190 × 37–50 µm, cylindrical to clavate, rounded at the top, stipitate at the base, 8-spored, spores uniseriate, biseriate, or irregularly arranged. Ascospores 15–18 µm in diameter, spherical, covered with 1.5–3 µm high, rod-like warts; hyaline when young, light brownish to greenish brown when mature.

Specimens examined—**TURKEY, Giresun, Dereli,** Ağaçbaşı nature park, 40°42′N 38°16′E, 1170 m, in soil under *Fagus* and *Carpinus*, 13.09.2017, Y. Uzun 5822 (KMU); **Trabzon, Sürmene,** Ormanseven village, 40°51′N 40°08′E, 360 m, in soil under *Alnus, Castanea,* and *Rhododendron*, 14.09.2017, Y. Uzun 5839 (KMU).

Comments—*Pachyphlodes conglomerata* has been reported to occur under a number of deciduous and coniferous trees (Soehner 1935, Lange 1956), including *Fagus* and *Quercus* sp. (Vidal 1997). The morphology of our samples agrees with previous descriptions, and their measurements also fall within the range given in literature. Soehner (1935), Vacek (1949), and Vidal (1997) reported maximum ascomatal sizes at or below 15 mm. Although some of our samples seem larger at 20 mm, they are not as large as the 15–30 mm specimens described by Hawker (1954).

Acknowledgments

The authors thank the Karamanoğlu Mehmetbey University Research Fund (02–D–17) for financial support and Prof. Dr. Ertuğrul Sesli, Dr. Vladimír Antonín, and Dr. Shaun Pennycook for their helpful comments and careful review.

Literature cited

Akata I, Sesli E. 2017. Four new records of *Basidiomycota* for the Turkish Mycota from Trabzon and İstanbul provinces. Mantar Dergisi 8(2): 168–177. https://doi.org/10.15318/Fungus.2017.48

Cazares E, Garcia J, Castillo J, Trappe JM. 1992. Hypogeous fungi from Northern Mexico. Mycologia 84: 341–359. https://doi.org/10.2307/3760186

Elliot TF, Türkoğlu A, Trappe JM, Yaratanakul Güngör M. 2016. Turkish truffles 2: eight new records from Anatolia. Mycotaxon 131: 439–453. https://doi.org/10.5248/131.439

Gilkey HM. 1939. *Tuberales* of North America. Oregon State College, Corvallis Oregon.

Gilkey HM. 1954. *Tuberales.* North American Flora, ser. 2, 1. 36 p.

Hawker LE. 1954. British hypogeous fungi. Philosophical Transactions of the Royal Society Biological Sciences 237: 429–546. https://doi.org/10.1098/rstb.1954.0002

Healy RA. 2003. *Mattirolomyces tiffanyae*, a new truffle from Iowa, with ultrastructural evidence for its classification in the *Pezizaceae.* Mycologia 95: 765–772. https://doi.org/10.1080/15572536.2004.11833078

Healy RA, Bonito G, Guevara G. 2009a. The truffle genus *Pachyphloeus* in the U.S. and Mexico: phylogenetic analysis and a new species. Mycotaxon 107: 61–71. https://doi.org/10.5248/107.61

Healy RA, Bonito G, Trappe JM. 2009b. *Calongea*, a new genus of truffles in the *Pezizaceae* (*Pezizales*). Anales de Jardin Botánico de Madrid 66: 25–32. https://doi.org/10.3989/ajbm.2213

Hensel G, Huth M. 2004. Beitrag zum Vorkommen der Chromgelben Kratertrüffel - *Pachyphloeus citrinus* Berk. & Br. (*Ascomycetes*). Feddes Repertorium, 115(1–2): 15–19. https://doi.org/10.1002/fedr.200311021

Işık H, Türkekul İ. 2017. A new record for Turkish mycota from Akdağmadeni (Yozgat) province: *Russula decolorans* (Fr.) Fr. Anatolian Journal of Botany 1: 1–3. https://doi.org/10.30616/ajb.342079

Kaya A, Uzun Y. 2015. Six new genus records for Turkish *Pezizales* from Gaziantep Province. Turkish Journal of Botany 39: 506–511. https://doi.org/10.3906/bot-1409-3

Kirk PM, Cannon PF, Minter DW, Stalpers JA. 2008. Dictionary of the fungi. 10th ed. Wallingford, UK: CAB International.

Læssøe T, Hansen K. 2007. Truffle trouble: what happened to the *Tuberales*? Mycological Research 111: 1075–1099. https://doi.org/10.1016/j.mycres.2007.08.004

Lange M. 1956. Danish hypogeous macromycetes. Dansk Botanisk Arkiv. 16(1), 84 p.

Pegler DN, Spooner BM, Young TWK. 1993. British truffles: a revision of British hypogeous fungi. Royal Botanic Gardens, Kew, 216 p.

Sesli E, Denchev CM. 2014. Checklists of the myxomycetes, larger ascomycetes, and larger basidiomycetes in Turkey. 6th ed. Mycotaxon Checklists Online. 136 p. (http://www.mycotaxon.com/resources/checklists/sesli-v106-checklist.pdf)

Sesli E, Vizzini A. 2017. Two new *Rhodocybe* species (sect. *Rufobrunnea, Entolomataceae*) from the East Black Sea coast of Turkey. Turkish Journal of Botany 41: 200–210. https://doi.org/10.3906/bot-1607-1

Soehner E. 1935. Bayerische *Pachyphloeus*-Arten. Hedwigia 75: 243–254.

Solak MH, Işıloğlu M, Kalmış E, Allı H. 2015. Macrofungi of Turkey, checklist, vol. 2. İzmir, Turkey: Üniversiteliler Ofset [in Turkish].

Trappe JM, Molina R, Luoma DL, Cázares E, Pilz D, Smith JE, Castellano MA, Miller SL, Trappe MJ. 2009. Diversity, ecology, and conservation of truffle fungi in forests of the Pacific Northwest. General Technical Report, Portland, U.S. https://doi.org/10.2737/PNW-GTR-772

Türkekul İ. 2017. New *Calbovista, Mycena, Rhizopogon, Stictis,* and *Symphyosirinia* records from Turkey. Mycotaxon 132: 503–512. https://doi.org/10.5248/132.503

Türkoğlu A, Castellano MA, Trappe JM, Yaratanakul Güngör M. 2015. Turkish truffles I: 18 new records for Turkey. Turkish Journal of Botany 39: 359–376. https://doi.org/10.3906/bot-1406-42

Uzun Y, Acar İ, Akçay ME, Kaya A. 2017a. Contributions to the macrofungi of Bingöl, Turkey. Turkish Journal of Botany 41: 516–534. https://doi.org/10.3906/bot-1611-14

Uzun Y, Karacan İH, Yakar S, Kaya A. 2017b. *Octospora* Hedw., a new genus record for Turkish *Pyronemataceae*. Anatolian Journal of Botany 1: 18–20. https://doi.org/10.30616/ajb.342114

Vacek V. 1949. Nová lanýžovitá houba v Čechách: *Pachyphloeus conglomeratus* Berk. et Br. skrytka pospolitá. Česká Mykologie 3(8–10): 119–121.

Vidal JM. 1997. Algunos hongos hipogeos nuevos o poco citados de Catalauna (*Zygomycotina, Ascomycotina* y *Basidiomycotina*). Revista Catalana de Micologia 20: 25–62.